

Claims

What is claimed is:

1. A Method to control the magnetic alloy-encapsulated carbon-base nanostructures, characterized in that, growing said magnetic alloy-encapsulated carbon-base nanostructures using magnetic field during magnetic alloy-encapsulated nanostructure deposition and post treatment for improved magnetic anisotropy by microwave plasma electron cyclotron resonance chemical vapor deposition at the power between 500W and 5000W and the working pressure less than 5×10^{-3} Torr; the catalyst and additive on surface of substrate using DC bias and heating treatment at temperature between 400 °C and 850 °C and then etching said substrate during plasma pretreatment; and the reaction gas with said electron cyclotron resonance microwave plasma deposition so as to form nanostructures.
2. The method according to claim 1, wherein said catalyst and said additive are selected from the group consisting of magnetic metal and alloy thereof.
3. The method according to claim 1, wherein said catalyst is selected from the group consisting of carbon-soluble metal such as iron (Fe), cobalt (Co), nickel (Ni), and alloys thereof such as iron- platinum (Fe-Pt) alloy, cobalt- platinum (Co-Pt), and nonmetal such as silicon (Si).
4. The method according to claim 1, wherein said catalyst comprises permanent magnetic rare earth element alloy having carbon solubility such as $\text{Nd}_2\text{Fe}_{14}\text{B}$, $\text{Sm}(\text{Co},\text{Cu})_5$.

5. The method according to claim 1, wherein said catalyst comprises lanthanides and alloy thereof.
6. The method according to claim 1, wherein said additive to change said catalyst activity or control the size, shape, directional growth and magnetic property of said nanostructures is selected from the group consisting of copper (Cu), gold (Au), platinum (Pt) and lanthanides.
7. The method according to claim 3, wherein said additive to change coercive force of said catalyst, single magnetic domain grain size and magnetic anisotropy is selected from the group consisting of copper (Cu), gold (Au), nitrogen (N), chromium (Cr), boron (B), titanium (Ti), vanadium (V), zirconium (Zr), yttrium (Y) and lanthanides.
8. The method according to claim 1, wherein said plasma pretreatment is to change the size, shape and activity of said catalyst.
9. The method according to claim 1, wherein said plasma pretreatment is to control the size, shape, and directional growth of said carbon-base nanostructures.
10. The method according to claim 1, wherein said substrate with enduring high-temperature metal or nonmetal is selected from the group consisting of silicon wafer, stainless steel and quartz glass.
11. The method according to claim 1, wherein the metal or nonmetal formed on said substrate with said catalyst by being selected from the group consisting of physical vapor deposition, chemical vapor deposition, electrochemistry, coating, and transfer printing.
12. The method according to claim 11, wherein said physical vapor deposition is selected from the group consisting of sputtering and evaporating.

13. The method according to claim 11, wherein said chemical vapor deposition is plasma enhanced chemical vapor deposition.
14. The method according to claim 11, wherein said electrochemistry is selected from the group consisting of electroplating and electroless plating.
15. The method according to claim 11, wherein said coating with metal salt or alloy salt thereof of catalyst, formed on said substrate by been selected from the group consisting of rotating coating and immersion plating, and then the metal catalyst or alloy catalyst with heating and reduction of said plasma pretreatment having hydrogen.
16. The method according to claim 11, wherein said transfer printing with metal salt or alloy salt thereof of catalyst, formed on said substrate by rubber elastomer, and then the metal catalyst or alloyed catalyst with heating and reduction of said plasma pretreatment of hydrogen.
17. The method according to claim 11, wherein surface figure of said substrate is a catalyst metal thin layer or grain layer by been selected from the group consisting of photo engraving process, electron beam lithography, printing, transfer printing and ion implantation.
18. The method according to claim 1, wherein catalyst of said surface substrate is a uniform thin layer pattern or grain layer pattern.
19. The method according to claim 1, wherein catalyst of said surface substrate is a non-uniform thin layer pattern or grain layer pattern.
20. The method according to claim 1, wherein said reaction gas is selected from the group consisting of carbon-containing gas and nitrogen-containing gas.
21. The method according to claim 20, wherein said carbon-containing gas

is selected from the group consisting of methane, ethane, propane, acetylene, benzene and mixture thereof.

22. The method according to claim 20, wherein said nitrogen-containing gas is selected from the group consisting of ammonia, nitrogen and mixed gas of chemical ammonia- base compound mixture of methane, ethane, propane, acetylene, benzene and mixture thereof.